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Metabolic syndrome and its predictors among the bankers

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Abstract

Metabolic syndrome is a cluster of risk factors that increases the chance for coronary heart disease (CHD) and other health problems such as diabetes and stroke. Metabolic syndrome (MS) now has become a global epidemic. Both developed and developing countries are increasingly vulnerable to the worldwide epidemic of metabolic syndrome, which affects all segments of the population specially those who lead sedentary life. Various medical problems like, cardiovascular diseases, type-2 diabetes mellitus etc. are associated with metabolic syndrome. Recently, we have witnessed a dramatic rise of the prevalence of metabolic syndrome among the people who leads sedentary lives. Among them bankers are a most important group because of their profession and social responsibilities. Increasing trend of metabolic syndrome among them is of serious concern in the context of healthy bankers and development of our country. To provide different types of preventive measures, we should know the magnitude of the problem by finding out the prevalence of metabolic syndrome among Bangladeshi bankers.

In this study our aim was to see the prevalence of metabolic syndrome among the bankers of Bangladesh and to evaluate two anthropometric indices like, WHR (waist-hip ratio), WHtR (waist-height ratio) and two biochemical indices such as Ttriacylglycerol, HDL-C (high density lipoprotein) for their predictive value of metabolic syndrome. With this aim 500 Bangladeshi bankers, age ranging from 25-55 years, of both sexes at least junior bank officer from government and private bank were enrolled and the study was carried out in the Department of Biochemistry, BSMMU, Shahbag, Dhaka, Bangladesh.

The study subjects were selected by convenient and purposive sampling technique. The study was a cross sectional study.

Foreigner bankers who are working in Bangladesh, pregnant female bankers, known endocrine disorders (like polycystic ovary syndrome, Cushing syndrome, hypothyroidism), antidepressant and anticonvulsant drug users and bankers aged more than 55 years were excluded from this study. Study subjects were categorized on the basis of sex, age groups, government and private sector. Presence of metabolic syndrome was diagnosed by modified NCEP ATP III criteria. Prevalence of metabolic syndrome was measured at 95% CI. According to set criteria, prevalence of metabolic syndrome was found 43.4% of total study subjects, among them 42.4% were male and 52.0% were female. Prevalence of metabolic syndrome in age group 25-40 years were 29.6% of male, 41.7% of female and in age group 40-55 years were 55.1% of male and 55.3% of female. It was found (49.8%) among government bankers and (36.3%) among private bankers. Proportion test was done to compare the prevalence of metabolic syndrome between male & female, government & private bankers and between age groups. Statistical significance was set at $p<0.05$. In our study it was found that the prevalence of metabolic syndrome was higher in female bankers in total population. In total subjects and male bankers, significantly higher prevalence of MS found in 40-55yrs age group than 25-40yrs, but in female statistically no significant difference. Prevalence increases according to the increase of age. There is significantly higher prevalence of metabolic syndrome found in government than private bankers. In our study, we have calculated SEN, SPE, PPV, NPV, LR^+, LR^- & Accuracy of WHR, WHtR, TAG & HDL-C as predictors of MS. In our study, the most sensitive predictor for male and female was found WHR (92.7% & 100.0%). On the other hand most specific predictor for male was HDL-C (72.2%) and female was TAG (100.0%).

ROC curves of WHR, WHtR, TAG and HDL-C were produced to see the area under the curve (AUC) and to evaluate their predictive value of metabolic syndrome. In our study all those indices were found good for their predictive value of metabolic syndrome. We calculated optimal cut of point (OCP) of WHR, WHtR, TAG and HDL-C as predictor for detection of MS in male, female and total study subjects on the basis of Youden's Index (Y-index). We found OCP of WHtR was 0.523 and that of TAG was 149.0mg/dl in total study subjects. OCP of WHR was found 0.934 in male, 0.889 in female and that of HDL-C was 39.0mg/dl in male, 44.0mg/dl in female respectively.

The findings of our study agreed the previous observations of increased prevalence of metabolic syndrome.

Key words: MS, WHR, WHtR, TAG & HDL-C, AUC, OCP, Y-index

Introduction

Metabolic syndrome (MS) is a cluster of widely prevalent multi-factorial medical disorders that presents in a distinct, albeit heterogeneous phenotype and increases the risk of developing cardiovascular disease and diabetes (Gogia and Agarwal, 2006).

In 1977, Haller used the term "metabolic syndrome" (Haller, 1977). It is also known as syndrome X or insulin resistance syndrome (Reaven, 1988). In 2001, National Cholesterol Education Program Adult Treatment Panel III (NCEP: ATP III) accepted the term "metabolic syndrome" (NCEP: ATP III, 2001).

The first formal definition of the MS was put forward in 1998 by the World Health Organization (WHO). This report was finalized in 1999 for individual having insulin resistance with any two of hypertension, dyslipidemia, central obesity and high urinary albumin excretion rate or high urinary albumin:creatinine ratio (Grundy et al. 2004).

Insulin resistance (IR) was regarded as Type 2 diabetes mellitus (DM2) or impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) or high serum insulin level. Hypertension was defined as blood pressure (BP) ≥140/90 mmHg or on medication. Dyslipidemia was regarded as having serum triacylglycerol (TAG) ≥ 150 mg/dl; high density lipoprotein cholesterol (HDL-C) <35 mg/dl (in male), <39mg/dl (in female). Central obesity was detected as BMI >30 kg/m^2 and/or Waist-Hip Ratio (WHR) >0.9 (in male), >0.85 (in female). The definition also included high urinary albumin excretion rate (≥ 20µg/min) or high urinary albumin:creatinine ratio (≥30mg/g).

The European Group for the Study of Insulin Resistance (EGIR) and International Diabetes Federation (IDF) published a separate set of criteria thereafter (Balkau and Charles, 1999; Anthony and Fauci, 2008). In 2001, the National Cholesterol Education Program Adult Treatment Panel III (NCEP: ATP III, 2001) published a new set of criteria based on common clinical measurements: Waist circumference (WC), blood lipids, blood pressure, and fasting glucose (Kay et al, 2004).

Metabolic syndrome (MS) is recognized worldwide as an important public health concern and the prevalence of MS varies considerably worldwide. Some studies estimate that about 47 million adults in United States (almost 25%) have MS, and the numbers continue to grow (Ford et al, 2002).

In line with the rising prevalence of obesity, the metabolic syndrome is also increasing in developing countries. The situation appears to be similar in South Asian countries. The recent data shows that one fourth to one third of urban population of India has the metabolic syndrome (Misra and khurana, 2009).

The prevalence of the metabolic syndrome depends on age, ethnic background and gender. Some racial and ethnic groups in the United States are more at risk for MS than others. Mexican Americans have the highest rate of MS (31.9%), whereas Caucasian (23.8%) and African Americans (21.6%) have lower rates. South Asians are also in increased risk for MS (Gogia and Agarwal, 2006).

MS affects one in five people, and prevalence increases with age. The MS affects 44% of the US population older than age 50. A greater percentage of women than men over 50 years old have the syndrome (Vega, 2001).

MS is a multiple disorder associated with cardiovascular diseases and is currently perceived as a serious public health problem by national and international authorities worldwide. Within this context, MS is considered to be a pre-diabetic state leading to DM2 (Aguilar-Salinas et al, 2004). Beyond cardio-vascular disease (CVD)

and DM2, individuals with MS are susceptible to other life threatening medical problems like polycystic ovarian syndrome, fatty liver, cholesterol gallstones, asthma, sleep disturbances and some forms of cancer (Grundy et al, 2004).

Central adiposity is a key feature of the metabolic syndrome, reflecting the fact that the prevalence of MS is driven by the strong relationship between waist circumference and increasing adiposity. However, patients of normal body weight may also be insulin-resistant and have the syndrome. Physical inactivity is an important factor of CVD events related mortality. Many components of MS are associated with the sedentary lifestyle including increased adipose tissue (predominantly central), reduced HDL-C and a trend toward increased triacylglycerol, blood pressure and fasting serum glucose in genetically susceptibles. MS affects the people of older age. The age dependency of the prevalence of MS was seen in most populations around the world. A greater percentage of women have the syndrome than men. The large majority of patients with DM2 or IGT have the MS. The presence of MS in these populations is associated with higher prevalence of CVD than in patients with DM2 or IGT without the metabolic syndrome. There is also a higher prevalence of MS in patients with coronary heart disease (CHD) particularly in women. It is also high in patients with premature coronary artery disease (age ≤45 yrs). Lipodystrophic disorders in general are associated with MS. Both genetic and acquired forms of lipodystrophy may give rise to severe insulin resistance and many of the components of MS (Gohill et al. 2001).

The prevalence of MS is increasing to epidemic proportions not only in the United States and the remainder of the urbanized world but also in developing nations and an increasing trend has been observed in Asian countries (Al-Lawati et al, 2003 and Chen et al, 2000).

Prevalence of metabolic syndrome in population of Sri Lanka is strikingly high as well; 35% in males and 51% in females. In the Sindh province of Pakistan, overall prevalence of the metabolic syndrome was 49% according to NCEP ATP-III. Prevalence of the metabolic syndrome is rapidly increasing in East Asia and China. High prevalence of the metabolic syndrome (22.9%) among adults in city of Shanghai, China has been reported. Data shows metabolic syndrome to be higher in South Asians

(men 29%, women 32%) than Caucasians (men 18%, women 14% in European) (Misra and khurana, 2009).

Another study also revealed that the prevalence of the metabolic syndrome was highest in South Asians (WHO, men 46%, women 31%; NCEP, men 29%, women 32%) and lowest in European women (WHO, 9%; NCEP, 14%) (Tillin et al. 2005).

Metabolic syndrome is not only a problem for the affluent class and for the western countries. It is a new hidden burden for the Bangladeshi population too. Urbanization, modern lifestyle, change of food habit cumulatively contributes for development of metabolic syndrome (Islam et al, 2009). In another study it was showed that Bangladeshis among the entire South Asian immigrants in UK had highest risk of morbidity and mortality from hypertension, DM2 and coronary artery disease (CAD) and these are emerging as major health problems in Bangladesh (McKeigue et al, 1988 and Wild et al, 2004).

Banking sector is rapidly expanding. Peoples are directly or indirectly depending on banking system. So bankers are an important segment of our community now-a-days. Therefore, knowledge and awareness regarding the health consequences of lifestyle changes should be build up among them. This in turn could influence the prevalence of lifestyle related diseases such as diabetes and hypertension among them (Ramachandran et al, 2008).

There is paucity of data on the lifestyle-associated disorders among physicians. But there is some data from Australia (Kay et al, 2004; Wachtel et al, 1995 and Nyman, 1991), New Zealand (Rechards, 1999), United Kingdom (Baldwin et al, 1997) and United States of America (Frank et al, 2000 and Frank, 2004).

In India, doctors found to have high prevalence of metabolic disorders that reflects their negative attitude to health care. Diagnosis of metabolic syndrome was made using the modified NCEP ATP III criteria to suit Indian population. Young Indian physicians found to have high rates of cardio-metabolic risk factors in comparison to the general population (29.0% vs 24.8%) and the proportion was higher in male doctors (30.2% vs 25.3%) while in the general population, it was more among females (36.2% vs 22.9%). Therefore doctors need to have motivation to follow good health care practices which they advocate to their clients (Ramchandran et al, 2008).

Bankers are sedentary worker. Doctors are also sedentary worker. But there is no particular data about prevalence and predictors of metabolic syndrome among bankers.

This clustering of risk factors in metabolic syndrome ultimately leads to diabetes and premature cardiovascular disease (Vega, 2001).

So, it is imperative to identify individuals with metabolic syndrome early so that lifestyle interventions and treatment can be started to prevent the development of diabetes and/or cardiovascular diseases. Bankers need to be motivated to practice good healthcare habits. With these in mind this study has been designed to find out the prevalence and predictors of metabolic syndrome among the bankers of Bangladesh.

Rationale of Study

For development of a country, a healthy community is essential. Now-a-days bankers are the important part of our community. It has been observed that the prevalence of metabolic syndrome is more in subjects who lead sedentary life. Bankers also lead a sedentary life. They do not have enough physical exercise. They also suffer from high stress. So, metabolic syndrome is suspected to be increased among the bankers, which is not good for our development because metabolic syndrome give rise to various life threatening medical problems like DM2, cardiovascular diseases, fatty liver, cholesterol gallstones, asthma and some forms of cancer. Thus the long term working capability of bankers suffering from MS will be vulnerable and development of our country will be affected.

Bankers' well being and good health is very much important since healthy bankers can perform healthy practice and can work for development of our nation. All the family members as well as taxpaying general people of our country spent a lot to produce a banker with the hope that he or she will serve for the community for a reasonable period and certainly nobody expect their premature morbidity and mortality.

So, this problem of MS among the bankers is uncalled for and must be prevented. It is possible to prevent or delay metabolic syndrome, mainly through lifestyle modification. Due care must be taken to deal this problem by implementation of multidimensional preventive strategies. To chalk out the preventive measures at the very onset we should know the magnitude of the problem by finding out the prevalence of metabolic syndrome among the bankers of Bangladesh. It is also important to identify the predictors of MS. Prevalence and predictors of a problem are the corner stones to be used in preventive strategies of this problem. So, we have designed this study to find out the magnitude of metabolic syndrome among the bankers of our country and we have made an attempt to evaluate WHR (Waist to Hip Ratio), WHtR (Waist to Height Ratio), TAG (Triacylglycerol) and HDL-C (High density lipoprotein cholesterol) as predictors of metabolic syndrome.

Findings of this study will help to build awareness about metabolic syndrome, which now-a-days is

of utmost importance worldwide, and may ultimately help to prevent MS among the bankers of Bangladesh. In an attempt to ensure a healthy bankers' community that is very much needed for a nation with respect to development, it should be sought out and due care should be taken. This study hopefully will make the bankers to be aware and to be more motivated to follow good health care practices. Awareness and motivation will help early detection of MS and its prevention among bankers to reduce their morbidity and mortality .

Results

During the period of January 2010 to December 2010 a total of 500 Bangladeshi bankers of both sexes from government and private bank were enrolled in this study. Among them 263 bankers were from government and 237 bankers were from private bank; 450 were male and 50 were female. To assess the prevalence of Metabolic Syndrome, anthropometric measurements (height, weight, waist circumference, hip circumference) as well as other biochemical measurements (glucose, TAG, HDL-C) and blood pressure of all study subjects were recorded. Metabolic Syndrome was defined according to the criteria described in modified NCEP ATP –III.

Table-1: Age (years) distribution of study subjects

Parameter	Total study subjects n=500	Male n=450	Female n=50
Mean age (m±SD)	40.7±8.8	40.6±8.9	41.6±7.8
Age range(years)	25 - 55	25 - 55	25 - 48

Table-1 shows age distribution of study subjects. Of total 500 study subjects male bankers were 450 (90.0%) and female bankers were 50 (10.0%). Age range of the study subjects was 25 to 55years with mean age (m±SD) 40.7±8.8 yrs in total study subjects, 40.6±8.9 yrs in male bankers and 41.6±7.8 yrs in female bankers.

Table-2: Anthropometric indices (mean±SD) of study subjects

Parameters	Total study subjects (n=500)	Male (n=450)	Female (n=50)
Height(cm)	162.4±6.0	163.4±5.2	153.5±6.2
Weight(kg)	67.0±9.7	67.5±9.7	60.5±7.4
WC (cm)	86.2±7.4	86.6±7.6	82.2±4.9
HC (cm)	92.6±6.0	92.7±6.2	92.3±4.7
WHR	0.9±0.0	0.9±0.0	0.9±0.0
WHtR	0.5±0.1	0.5±0.1	0.5±0.0
BMI	25.3±3.2	25.3±3.3	25.6±2.1

WC: Waist circumference, **HC:** Hip circumference, **WHR:** Waist to hip ratio, **WHtR:** Waist to height ratio, **BMI:** Body mass index.

Table-2 shows m±SD of anthropometric indices. Mean height (cm) of total study subjects was 162.4±6.0, and that of male and female were 163.4±5.2 and 153.5±6.2 respectively. Mean body weight (kg) of total study subjects was 67.0±9.7, and that of male and female were 67.5±9.7 and 60.5±7.4 respectively. Mean waist circumference (cm) of total study subjects was 86.2±7.4, and that of male and female were 86.6±7.6 and 82.2±4.9 respectively. Mean hip circumference (cm) of total study subjects was 92.6±6.0, and that of male and female were 92.7±6.2 and 92.3±4.7 respectively. Mean WHR of total study subjects as well as of male and female were 0.9±0.0 . Mean WHtR of total study subjects as well as of male and female were 0.5±0.1; 0.5±0.1 and 0.5±0.0 respectively . Mean BMI (kg/m2) of total study subjects was 25.3±3.2, and that of male and female were 25.3±3.3 and 25.6±2.1 respectively.

Table-3: Biochemical and other indices (mean±SD) of study subjects

Parameters	Total study subjects (n=500)	Male (n=450)	Female (n=50)
SBP (mmHg)	121.3±13.2	121.7±12.9	117.8±15.3
DBP (mmHg)	80.8±8.7	81.0±8.8	78.4±7.4
FSG (mmol/L)	5.3±1.4	5.3±1.5	5.2±0.8
TAG (mg/dl)	168.3±57.5	170.1±58.6	152.1±43.6
HDL-C (mg/dl)	42.5±7.5	42.2±7.7	44.8±5.5

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, FSG: Fasting serum glucose, TAG: Triacylglycerol, HDL-C: High density lipoprotein cholesterol.

SBP(mmHg) was 121.3±13.2 for total study subjects; 121.7±12.9 and 117.8±15.3 were for male and female respectively. DBP(mmHg) was 80.8±8.7 for total study subjects; 81.0±8.8 and 78.4±7.4 were for male and female respectively. FSG(mmol/L) was 5.3±1.4 for total study subjects; 5.3±1.5 and 5.2±0.8 were for male and female respectively. TAG(mg/dl) was 168.3±57.5 for total study subjects; 170.1±58.6 and 152.1±43.6 were for male and female respectively. HDL-C(mg/dl) was 42.5±7.5 for total study subjects; 42.2±7.7 and 44.8±5.5 were for male and female respectively (Table-3).

Table-4: Distribution of the components of MS among the study subjects

Parameters		Total (N= 500)	Male (n= 450)	Female (n= 50)
WC (M- >90cm,F- >80cm)		194	156	38
BP	SBP (>130mmHg)	177	161	16
	DBP (>85mmHg)	196	185	11
FSG (>6.1mmol/L)		85	74	11
TAG (>150mg/dl)		276	255	21
HDL-C (M <40mg/dl,F<50mg/dl)		195	150	45

WC: Waist circumference, BP: Blood pressure, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, FSG: Fasting serum glucose, TAG: Triacylglycerol, HDL-C: High density lipoprotein cholesterol.

Table-4 shows the distribution of the components of metabolic syndrome among the study subjects. Out of 450 male, 156 had waist circumference >90cm and 38 female out of 50 had waist circumference >80cm. 161 and 185 male had SBP >130mmHg and DBP >85mmHg where as 16 and 11 female had SBP >130mmHg and DBP >85mmHg respectively. FSG >6.1mmol/L found in 74 male and 11 female, TAG >150mg/dl found in 255 male and 21 female bankers. HDL-C <40mg/dl was found in150 male and HDL <50mg/dl was found in 45 female bankers respectively.

Table-5: Frequency and prevalence of metabolic syndrome (MS) among the study subjects

Study subject	Frequency of MS	Prevalence	
		Point estimate	95% CI
Total (n= 500)	217	43.4%	39.1-47.7
Male (n=450)	191	42.4%	37.8-47.0
Female (n=50)	26	52.0%	38.1-65.9

Out of the total population (n=500), 217 had metabolic syndrome, of which 191 were male and 26 were female. The prevalence of MS (95% CI) among the total population was found to be 43.4% (39.1-47.7) and that in male and female bankers were 42.4% (37.8-47.0) and 52.0% (38.1-65.9) respectively (Table-5).

Table-6: Frequency and Prevalence of Metabolic Syndrome in different age groups of study subjects

Distribution of study subjects (n=500)			Frequency of MS	Prevalence	
Age group (years)	Sex distribution	Number		Point estimate	95% CI
25-40	**Both sex**	235	71	30.2%	24.3-36.1
	Male	223	66	29.6%	23.6-35.6
	Female	12	05	41.7%	13.9-69.5
40-55	**Both sex**	265	146	55.1%	49.1-61.1
	Male	227	125	55.1%	49.1-61.1
	Female	38	21	55.3%	39.4-71.2

According to the age, total study subjects were classified into two groups, 25-40years and 40-55years. In the age group 25-40years, total bankers were 235, of which 223

were male and 12 were female. In the age group 40-55years, total bankers were 265, of which 227 were male and 38 were female. In age group 25-40 yrs, 71 (male 66 and female 05) bankers and in age group 40-55 yrs. 146 (male 125 and female 21) bankers found to have MS. Prevalence of MS in age group 25-40 yrs. and 40-55 yrs were 30.2%, and 55.1% respectively and that of male and female in age group 25-40 yrs and 40-55 yrs was 29.6% vs. 55.1% and 41.7% vs. 55.3% respectively (Table-6).

Table-7: Frequency and prevalence of MS in Government and Private bankers

Distribution of study subjects (n=500)			Frequency of MS	Prevalence	
Area distribution	Sex distribution	Number		Point estimate	95% CI
Government	Both sex	263	131	49.8%	43.8-55.2
	Male	224	108	48.2%	41.7-54.7
	Female	39	23	58.9%	43.5-74.3
Private	Both sex	237	86	36.3%	30.2-42.4
	Male	226	83	36.7%	30.4-43.0
	Female	11	03	27.3%	01.0-53.6

Table-7 shows frequency and prevalence of metabolic syndrome with 95% CI in government and private bankers. In both sex, 131 and 86 bankers of government and private respectively had MS, where 108 male & 23 female of government and 83 male & 03 female of private had MS. Among the male of government and private MS was 48.2% & 36.7%; and that among the female was 58.9% & 27.3% respectively. It was 43.4% in both sexes of government and private study subjects.

Table-8: Comparison of Metabolic Syndrome in respect of sex, age group and Government/ Private

Population	Male	Female	P-value
Total	42.4%	52.0%	P>0.05
25-40yrs	29.6%		P>0.05
40-55yrs	55.1%	55.3%	P>0.05
Government	48.2%	58.9%	P>0.05
Private		27.3%	P>0.05

P-value was obtained by Z-test of proportion

Table-8 shows the comparison of MS between male and female study population. With respect to age groups 25-40yrs, 40-55yrs, government - private and total study subjects prevalence of MS between male and female found identical.

Table-9: Comparison of Metabolic syndrome in different age groups

Population	25-40 yr.	40-55 yr.	P-value
Total	30.2%	55.1%	P<0.05
Male	29.6%	55.1%	P<0.05
Female	41.7%	55.3%	P>0.05
Government	29.8%	59.2%	P<0.05
Private	30.5%	46.5%	P<0.05

P-value was obtained by Z-test of proportion

Comparisons of Metabolic syndrome in different age groups were shown in Table-9. Among the female bankers, same prevalence of MS found in both age groups but among total subjects, the male, government and private bankers prevalence of MS found significantly higher in 40-55yrs age group.

Table-10: Comparison of MS in Government and Private bankers

MS	In Government	In Private	P-value
Total population	49.8%	36.3%	P<0.05
Male	48.2%	36.7%	P<0.05
Female	58.9%	27.3%	P<0.05

P-value was obtained by Z-test of proportion

There were significantly higher prevalence of MS found with respect to total population, male and female in government bank (Table-10).

Performance test of WHR, WHtR, HDL-C and TAG were done for prediction of MS (Table 11-20). Performance of WHR for prediction of MS in male and female were shown in Table-11 and Table-12 respectively. Table -13, 14, 15 show the performance of WHtR for prediction of MS in both sex, male and female respectively. Performances of HDL-C for prediction of MS in male and in female were shown in Table- 16 & 17. Table 18, 19 & 20 display the performances of TAG for prediction of MS in both sex, male and female.

Table-21: Summary of the performance of WHR, WHtR, TAG and HDL for prediction of MS

Performance tool	Predictors									
	WHR		WHtR			TAG			HDL-C	
	M	F	M	F	T	M	F	T	M	F
SEN	92.7	100.0	91.1	96.2	91.7	80.6	80.0	80.7	42.4	100.0
SPE	23.2	37.5	29.7	33.3	30.0	63.1	100.0	66.1	72.2	20.8
PPV	47.1	63.4	48.9	61.0	50.1	61.8	100.0	64.6	52.9	57.8
NPV	81.1	100.0	81.9	88.9	82.5	81.4	81.3	81.7	63.0	100.0
Accuracy	52.7	70.0	55.8	66.0	56.8	70.6	89.3	72.4	59.6	62.0
LR+	01.2	01.6	01.3	01.4	01.3	02.2	00.8	02.4	01.5	01.3
LR-	00.3	00.4	00.3	00.1	00.3	00.3	00.2	00.3	02.1	00.2

WHR= Waist–Hip Ratio, WHtR= Waist-Height Ratio, TAG= Triacylglycerol, HDL-C= High Density Lipoprotein cholesterol, MS= Metabolic Syndrome, M=Male, F=Female, T=Total study subject

Table-21 summarizes the results of performance of predictor variables (WHR, WHtR, HDL-C, TAG) for prediction of MS.

Sensitivity of WHR,WHtR, TAG and HDL-C in male and female were 92.7% & 100.0%, 91.1% & 96.2%, 80.6% & 80.0% and 42.4% & 100.0% respectively. Specificity of WHR, WHtR, TAG and HDL-C in male and female were 23.2% & 37.5%, 29.7% & 33.3%, 63.1% & 100.0% and 72.2% & 20.8% respectively. Positive predictive value and Negative predictive value of WHR, WHtR, TAG and HDL-C in male were 47.1% & 81.1%, 48.9% & 81.9%, 61.8% & 81.4%, 52.9% & 63.0% and in female were 63.4% & 100.0%, 61.0% & 88.9%, 100.0% & 81.3%, 57.8% & 100.0% respectively. Accuracy of WHR, WHtR, TAG and HDL-C in male and female were 52.7% & 70.0%, 55.8% & 66.0%, 70.6% & 89.3% and 59.6% & 62.0% respectively. Positive Likelihood Ratio and Negative Likelihood Ratio of WHR, WHtR, TAG and HDL-C in male were 01.2% & 00.3%, 01.3% & 00.3%, 02.2% & 00.3%, 01.5% & 02.1% and in female were 01.6% & 00.4%, 01.4% & 00.1%, 00.8% & 00.2%, and 01.3 % & 00.2% respectively. Sensitivity, Specificity, Positive predictive value, Negative predictive value, Positive Likelihood Ratio, Negative Likelihood Ratio and Accuracy of WHtR and TAG in total population were 91.7%, 30.0%, 50.1%, 82.5%, 01.3%, 00.3%, 56.8% and 80.7%, 66.1%, 64.6%, 81.7%, 02.4%, 00.3%, 72.4% respectively.

Figure-1&2 show ROC curve of the performance of WHtR and TAG as predictors of MS in total population (both sex). ROC curve of the performance of WHR, WHtR, TAG and HDL-C as predictors of MS in male and female were shown in Figure-3-6 & 7-10 respectively.

Table-22 shows Area under the ROC curve (AUC) representing the weightage of WHtR and TAG as predictors in total population for detection of MS. AUC for WHtR was 0.706 and that for TAG was 0.770. Table-23 & Table-24 show area under the ROC curve (AUC) representing the weightage of WHR, WHtR, TAG and HDL-C as predictors in male and female for detection of MS. In male the area under the curve for WHR, WHtR, TAG and HDL-C were 0.673, 0.719, 0.746 and 0.513; whereas in female these were 0.667, 0.543, 1.000 and 0.780 respectively.

Table-25: Optimal cut of point (OCP) of WHtR, TAG, WHR and HDL-C as predictor for detection of MS in male, female and total population (both sex)

Predictors		OCP	SEN	SPE
WHtR	**Both sex**	0.523	0.802	0.558
TAG	**Both sex**	149.0	0.802	0.640
WHR	**Male**	0.934	0.723	0.595
	Female	0.889	0.692	0.667
HDL-C	**Male**	39.0	0.730	0.435
	Female	44.0	1.0	0.577

OCP calculated on the basis of Youden's index (Y-index).

Table-25 shows optimal cut of point (OCP) of WHtR, TAG, WHR and HDL-C as predictor for detection of MS in male, female and total population (both sex). OCP of WHtR was 0.523 (SEN 0.802, SPE 0.558) and that of TAG was 149.0mg/dl (SEN 0.802, SPE 0.640) in total population. OCP of WHR was 0.934 (SEN 0.723, SPE 0.595) in male, 0.889 (SEN 0.692, SPE 0.667) in female. OCP of HDL-C was 39.0mg/dl (SEN 0.730, SPE 0.435) in male, 44.0mg/dl (SEN 1.0, SPE 0.577) in female.

Discussion

In this cross sectional study, our aim was to measure the prevalence of metabolic syndrome (MS) among the Bangladeshi bankers and to determine the predictive value of WHR, WHtR, TAG and HDL-C for detection of metabolic syndrome among them. With this aim, we have enrolled 500 Bangladeshi bankers of both sexes from government and private and metabolic syndrome was identified according to modified NCEP ATP-III criteria. The bankers are members of affluent society. They usually live sedentary life. But they have experience different types of mental stress due to their duties.

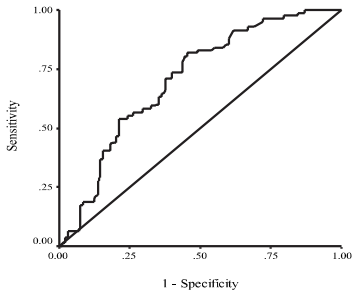

Figure-1: ROC curve for WHtR as predictor for detection of MS in total population (both sex).

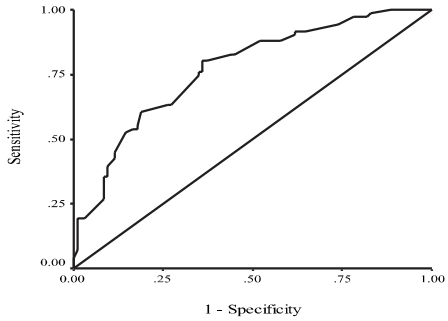

Figure-2: ROC curve for TAG as predictor for detection of MS in total population (both sex).

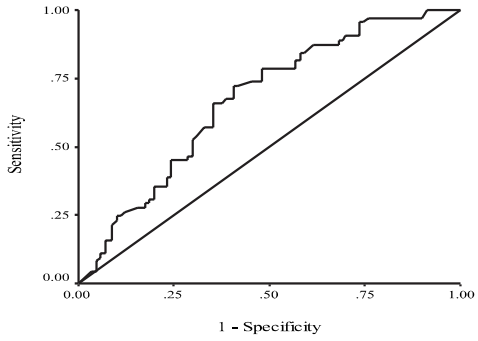

Figure-3: ROC curve for WHR as predictor for detection of MS in male.

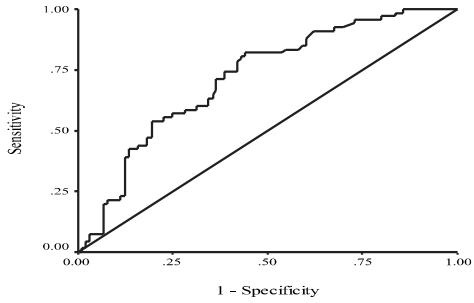

Figure-4: ROC curve for WHtR as predictor for detection of MS in male.

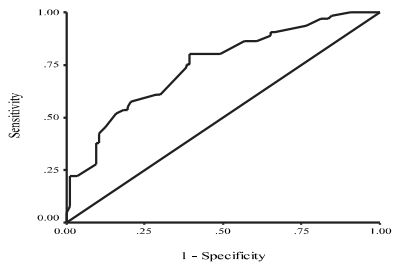

Figure-5: ROC curve for TAG as predictor for detection of MS in male.

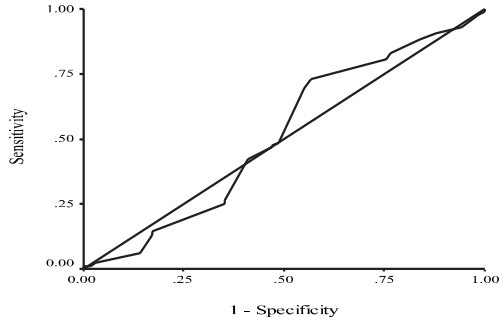

Figure-6: ROC curve for HDL-C as predictor for detection of MS in male.

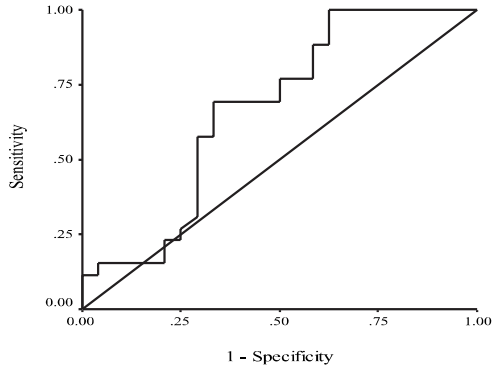

Figure-7: ROC curve for WHR as predictor for detection of MS in female.

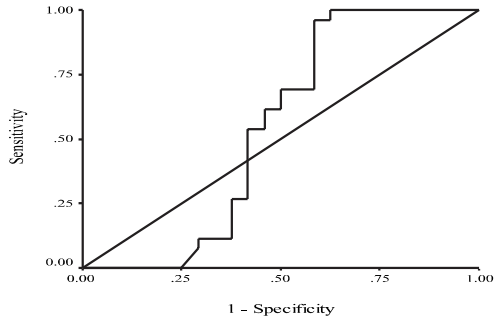

Figure-8: ROC curve for WHtR as predictor for detection of MS in female.

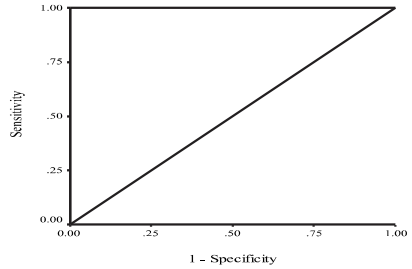

Figure-9: ROC curve for TAG as predictor for detection of MS in female.

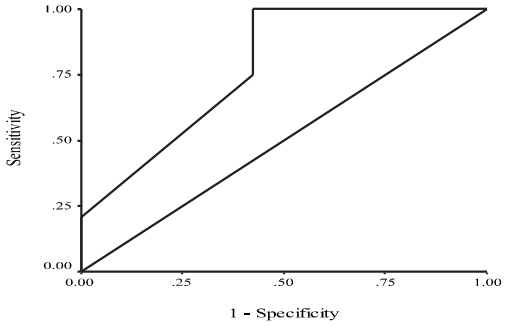

Figure-10: ROC curve for HDL-C as predictor for detection of MS in female.

The prevalence of metabolic syndrome was high among bankers in our study. In total participants (mean age 40.7±8.8 yrs) the prevalence was 43.4%, in male it was 42.4% and in female 52.0%. As our participants are bankers they are comparable with persons of others sedentary workers. Our finding is supported by Ramachadran et al (2008). They conducted a study among 2499 Indian physician of mean age 39.0±9.0 yrs and found the prevalence of metabolic syndrome 29.0%. They concluded that in India, doctors had high prevalence of metabolic syndrome.

This finding is supported by the statement of Ford et al (2002) & Misra and Khurana (2009). Ford et al (2002) concluded that the metabolic syndrome is highly prevalent in US population & Mexican Americans have the highest prevalence of the metabolic syndrome (31.9%). Mishra and Khurana (2009) stated that overall prevalence of the metabolic syndrome in the Sindh province of Pakistan was 34.8% and 49% according to IDF

and modified NCEP ATP III respectively. They also stated that South Africa, Turkey, and Iran showed prevalence of 33.5%, 33.4%, and 33.7%, respectively.

The prevalence rates are also high in general population of Venezuela (31.2%) and urban Brazil (25.4%) (Florez et al. 2005 and Marquezine et al. 2008). These also supported our findings.

In our study 191 (42.4%) male bankers & 26 (52.0%) female bankers were suffering from metabolic syndrome. The prevalence of metabolic syndrome in male and female had no significant difference.

In most of the studies in different countries around the world, prevalence of MS was found higher in female than male- in north India 15.6% vs 13.3% (Misra et al. 2001), in Turkey 38.6% vs. 27.0% (Onat et al. 2002), in urban south India 46.5% vs. 36.4% (Ramachandran et al. 2003), in urban Tehran of Iran 42.0% vs. 24.0% (Azizi et al. 2003), in Mauritius 14.7% vs. 10.6% (Cameron et al. 2003), in Oman 23.0% vs. 19.5% (Al-Lawati et al. 2003), in urban north India 39.9% vs 22.9% (Gupta et al. 2004), in Turkey 39.1% vs. 23.7% (Ozsahin et al. 2004), in Korea 17.7% vs. 14.2% (Park et al. 2004), in China 17.8% vs. 9.8% (Gu et al. 2005). In our study we also have found the prevalence of MS to be higher in female bankers (52.0%) than male bankers (42.4%). Our findings are also supported by another finding in rural area of Brazil; the prevalence was 7.7% for men and 33.6% for women (Maléndez et al. 2007).

But in some other studies done in different developing countries around the world including South Asian region prevalence of MS found higher in male which is contrary to our findings; in urban Korea 29.0% vs. 16.8% (Oh et al. 2004), in Singapore 20.9% vs. 15.5% (Tan et al. 2004), in Shanghai, China 22.9% vs. 20.8% (Fan et al. 2005), in rural India 32.5% vs 23.9% (Chow et al. 2008).

In a study among young physicians, Ramachandran (2008) also showed that the prevalence of MS was higher among male doctor (30.2%) than female (25.3%) which is contrary to our findings.

In our study, the prevalence of MS found 42.4% in both government and private bankers. The prevalence of metabolic syndrome in government and private bankers had significant difference. In government bankers it was 48.2% in male & 58.9% in female, whereas in private bankers 36.7% in male & 27.3% in female.

A study in rural Japan carried out in 2005 showed a low prevalence of MS and it was 4.6% in males and 4.25 in females (Morimoto et al. 2008). Another study carried out in 2006 on rural Bangladeshi women also revealed low prevalence of MS (<3%) (Zaman et al. 2006). It is contrary to our study.

Morimoto et al. (2008) explained that lower prevalence of MS may be due to consumption of traditional Japanese food and the higher levels of regular physical activities of the farmers.

Zaman et al (2006) explained that physical activity level in this agricultural population is high because of their traditional lifestyle. Regular physical activity reduces obesity, increases HDL cholesterol, and decreases triglycerides.

On the contrary our samples were living with less physical activity, habit of taking rich food and stressful life. So it is likely that the prevalence of metabolic syndrome will be more in our study.

Our study revealed that prevalence of MS increases with age in both sexes and that was significantly high at the age group 40-55yrs than the age group 25-40yrs. We have found the prevalence of MS 30.2% in 25-40yrs age group (male 29.6%, female 41.7%) and 55.1% in 40-55yrs age group (male 55.1%, female 55.3%).

Ford et al. (2002) reported that the prevalence of MS was the lowest at the age group 30-39yrs (15.34%), while it was at the age group 50-59yrs (27.98%).

However epidemiologic studies have demonstrated differences in prevalence by age, gender, and ethnicity. Most, but not all, studies reported a higher prevalence of the metabolic syndrome among women compared with men (Razzouk & Muntner, 2009).

At age group 25-40yrs and age group 40-55yrs, the prevalence of MS found higher in female than male in our study but not significantly different.

In our study, we have calculated SEN, SPE, PPV, NPV, LR^+, LR^- & Accuracy of WHR, WHtR, TAG & HDL-C as predictors of MS.

In our study, WHR showed SEN 92.7%, SPE 23.2% for male & SEN 100.0%, SPE 37.5% for female; WHtR showed SEN 91.1% & SPE 29.7 % for male, SEN 96.2% & SPE 33.3 % for female, SEN 91.7% & SPE 30.0% for total study subjects; TAG showed SEN 80.6% & SPE 62.9% for male, SEN 80.8% & SPE 100.0% for female, SEN 80.7% & SPE 66.1% for total study subjects; and HDL-C showed SEN 42.4%, SPE 72.2% for male & SEN 100.0%, SPE 20.8% for female.

Dhanaraj et al (2008) found TAG in the overall population SEN 73.3%, SPE 77.8%. In that study HDL-C for men showed SEN 55.8%, SPE 90.2% and HDL-C for women showed SEN 87.0%, SPE 87.5%; WC for men showed SEN 67.3%, SPE 72.3% and WC for women showed SEN 73.5%, SPE 70.6%.

In another study carried out in the department of Biochemistry, Dhaka Medical College, Dhaka in 2010 by Khanam et al. Their statistical analysis of TAG showed SEN 74.3%, SPE 54.7%; HDL-C for male showed SEN 66.7%, SPE 23.3% and for female showed SEN 66.7%, SPE 40.0%. In their study WHR for male showed SEN 100.0%, SPE 10.0% and for female WHR showed SEN 100.0% (Khanam et al. 2010).

But, in their study Mombelli et al found SEN 92.0%, SPE 28.1% in male and SEN 87.4%, SPE 37.6% in female for WHtR.

In our study, the most sensitive predictor for male was found WHR (92.7%) followed by WHtR (91.1%), TAG (80.6%) & HDL-C (42.4%). The most sensitive predictor for female was found WHR (100.0%) and HDL-C (100.0%) followed by WHtR (96.2%) & TAG (80.0%). On the other hand most specific predictor for male was HDL-C (72.2%) followed by TAG (63.1%), WHtR (29.7%) and WHR (23.2%) and most specific predictor for female was TAG (100.0%) followed by WHR (37.5%),WHtR (33.3%) and HDL-C (20.8%).

ROC curves of WHR, WHtR, TAG and HDL-C were produced to see the area under the curve (AUC) and to evaluate their predictive value of metabolic syndrome. AUC of WHR were 0.673 (male) & 0.667 (female), WHtR 0.719 (male), 0.543 (female) & 0.706 (both sex); TAG 0.746 (male), 1.000(female), 0.770 (both sex) and HDL-C 0.513 (male), 0.780 (female).

In one study, according to modified NCEP ATP III criteria, Dhanaraj et al observed AUC of WHR (men 0.671, women 0.691), TAG (overall 0.777, men 0.796, women 0.770) and HDL-C (men 0.688, women 0.885). They did not evaluate WHtR as a predictor. In 2009, Mombelli et al carried a study among Italian population and he selected WHtR as a predictor of MS and found AUC 0.713 in male and 0.701 in female.

In our study all those indices were found good (AUC >0.5) for their predictive value of metabolic syndrome; and it was also revealed that WHtR was better than WHR as an index for metabolic syndrome in male which is in agreement with other previous studies (Mombelli et al, 2009 and

Weili et al, 2007). But in female WHR was better than WHtR.

We calculated optimal cut of point (OCP) of WHR, WHtR, TAG and HDL-C as predictor for detection of MS in male, female and total study subjects on the basis of Youden's Index (Y-index). It was the value of predictor at which highest Y-index achieved.

We found OCP of WHtR was 0.523 and that of TAG was 149.0mg/dl in total study subjects. OCP of WHR was found 0.934 in male, 0.889 in female and that of HDL-C was 39.0mg/dl in male, 44.0mg/dl in female respectively.

These findings were nearly consistent to the findings of Dhanaraj et al. (WHR 0.91 in male & 0.87 in female, HDL-C 39mg/dl in male & 50mg/dl in female), Mombelli et al. (WHtR≥0.5 in all) but Weili et al. found lower threshold for WHtR in children and adolescents (0.485 in boys, 0.475 in girls) (Dhanaraj et al. 2008, Mombelli et al. 2009 and Weili et al. 2007).

WHR and WHtR are not the diagnostic criteria for diagnosis of MS according to modified NCEP ATP III. WHR is a criteria of modified WHO. But we have taken WHR and WHtR as the predictors of MS, because there is variation of value of WC in different diagnostic groups as well as in different sex and ethnic groups.

BMI is clearly dependent on the height of the individual, but does not provide much information on the presence of abdominal fat. Greater BMI indicates general obesity and larger WC indicates central obesity, whereas WHR indicates excessive fat on the upper part of the body or abdomen. So WHR & WHtR can play an important role in diagnosis/ detection of MS in non-obese MS individuals in comparison with the non-obese without MS individuals (Dhanaraj et al. 2008).

WC is also a determinant, but different WC thresholds for the identification of the metabolic syndrome have been reported. Furthermore, determination of an enlarged WC may prove technically problematic and frequently with poor reliability. When evaluating different WC cutoffs in large populations of European ancestry (by using NCEP ATP III vs. IDF criteria), the prevalence of metabolic syndrome was essentially identical, and cardiovascular disease risk factors status did not vary substantially when subjects were divided on the basis of WC or BMI. The advantage of the WHtR is the opportunity of using a common threshold for different populations. A threshold value of WHtR ≥0.5 may, in fact provide an optimal common anthropometric index (Mombelli et al. 2009).

Conclusion

It can be apparently concluded that, the prevalence of metabolic syndrome is alarmingly high among the bankers of Bangladesh. It was 43.4% in total study subjects, and the prevalence of metabolic syndrome in male (42.4%) & in female (52.0%) bankers were significantly similar. In age group 25-40yrs the prevalence of metabolic syndrome of female (41.7%) was higher than male (29.6%) and it was higher in older age group (40-55yrs) of total study subjects (55.1%), male bankers (55.1%) & female bankers (55.3%) than younger age group (25-40yrs). It was found significantly higher among government (49.8%) than private bankers (36.3%). The most sensitive predictor for both male & female was found WHR (92.7% & 100.0%) and most specific predictor for male & female was found HDL-C (72.2%) & TAG (100.0%) respectively. All the indices (WHR, WHtR, TAG, HDL-C) were found good (AUC >0.5) for their predictive value of metabolic syndrome. Optimal cut of point (OCP) of TAG was found 149.0mg/dl. OCP of WHR, WHtR found greater and that of HDL-C lower than set

criteria. The study also found that increased waist to hip ratio (>0.90 in male and >0.85cm in female), waist to height ratio (≥0.5), high fasting triacylglycerol level (≥150mg/dl), low HDL-cholesterol (<40mg/dl in male and < 50 mg/dl in female) are good predictor of metabolic syndrome.

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